

specific gravity is 30·000 : its hardness just sufficient to scratch calcareous spar. Its crystals, which are tolerably transparent, are of a dark green colour, with sometimes a brownish tinge; and when a decomposition takes place, the crystals pass into the state of a pulverescent oxide of a fine reddish yellow colour.

The 2nd species is denominated cupro-martial arseniate. Its crystals are of an uncommon brilliancy, and perfectly transparent: their form is a rhomboidal tetraedral prism. Its specific gravity is 34·003 : its hardness rather greater than that of the arseniate of iron; the colour, a very faint sky-blue, sometimes a little deeper. Hitherto this ore has not been met with in any form but that of a perfect crystal.

Analysis of the Arseniates of Copper, and of Iron, described in the preceding Paper; likewise an Analysis of the red octaedral Copper Ore of Cornwall; with Remarks on some particular Modes of Analysis. By Richard Chenevix, Esq. M.R.I.A. Communicated by the Right Hon. Sir Joseph Banks, Bart. K.B. P.R.S. Read March 5, 1801. [Phil. Trans. 1801, p. 193.]

After having perused the accurate detail of the external characters and crystalline varieties by which Count de Bournon, in a paper he lately communicated to the Society, identified the several species of the ores mentioned in the title, the mineralogist will surely be gratified to find in this, which may be considered as a continuation of the Count's treatise, an elaborate analytical investigation, whereby not only the above-mentioned classification is fully confirmed, but also some progress is made in the theory of the docimastic art. After pointing out the principal imperfection of this art, and in what manner more precision is likely to be obtained, both as to the processes and the terms used in describing them, Mr. Chenevix enters into a full detail of the mode in which he proceeded in his inquiry, and of the many precautions he used in order to obviate every possible deception. The results, he repeatedly declares, have been to him singularly satisfactory, as they fully evince that great confidence can be placed in the crystallographical arrangement, and that in fact the evidence obtained by the two modes reciprocally contribute to confirm the inferences derived from each.

These results, as far as they relate to the arseniates of copper, are briefly these:—

The natural arseniate of copper exists in three different states of combination; the first containing 14, the second 21, and the third 28 per cwt. of the arsenic acid.

Each of these may contain different proportions of water, either as constituting a hydrate, or as water of crystallization.

Upon losing their water they generally pass from a blue to a pale green colour, and finally to brown.

One species only, being the first of the Count's classification, can be considered as a real arseniate of copper; the others, from the

quantity and combination of the water they contain, being more properly arseniates of hydrate of copper.

This first species is not to be put on the same footing with the others; since, by admitting a due proportion of water, it would, by calculation, be reduced to a lower class than that which it really occupies.

Lastly, the proportion of acid in each of the species except No. 2. is here assigned. And as to this last-mentioned species, it is observed, that it is to be considered as a particular variety, consisting of a much greater proportion of oxide, with a less quantity of water, combined with nearly the same proportion of arsenic acid.

After having carefully examined the natural arseniates, Mr. Chenevix paid some attention to a few artificial ones, being precipitates from nitrate of copper, by an arseniate of ammonia. And here he found very different proportions of the ingredients, the arsenic acid in one species being no less than 40 per cent. Hence we gather, that only two simple ingredients, combined in four different proportions, produce no less than eleven different species or combinations, which are now determined both by external and chemical characters.

Speaking next of the arseniates of iron, Mr. Chenevix observes, that they have but lately been distinguished from those of copper. One species, in fact, contains a sufficient proportion of this last metal to merit the name of *cupreous arseniate of iron*. This proportion was 27·5 of iron to 22·5 of copper, both in the oxide state; the arsenic acid amounting to 33·5, whilst 12 of water and 3 of silica made up within $1\frac{1}{2}$ the 100 parts on which the experiment was tried. The proportions of what is properly called the *arseniate of iron* were 45 oxide of iron, 9 oxide of copper, 31 arsenic acid, 10 water, and 4 silica. Upon this ore are often seen certain crystals of a cubic form and of a deep brownish red, which, according to Count de Bournon, are in a state of decomposition. These were found to contain but little acid or water, probably owing to their decomposition.

Artificial arseniates of iron, produced by the decomposition of green and red sulphate of iron by arseniate of ammonia, were next examined. The ingredients of the green arseniate were found to be, 43 oxide of iron, 38 arsenic acid, and 19 water; and of the red arseniate, 36·5 oxide of iron, 41·5 arsenic acid, and 20 water.

Observing in the course of these experiments a great variety of appearances assumed by the combinations of iron with salts, the oxygen, and other ingredients, the author enters into a curious inquiry on this subject; from which he deduces, in particular, the great variety of colours exhibited by that metal in divers stones or fossils, in which that variety, he infers, is derived from the different degrees of oxygenation of the iron.

In a third section the author enters into an analysis of a red octaedral copper ore found in Cornwall, of which he had occasion to examine several specimens in the preceding investigation. After describing several fruitless attempts, chiefly by means of acids, to

decompose this ore, he had recourse to a process to which he was led by some instances he had before observed, in which a mixture of two compounds of the same ingredients, but in different proportions, remained insoluble, while a third substance seemed to operate upon at least one of these two compounds, and to produce the decomposition that was aimed at. The following is the manner in which he explains this operation:—When a metallic oxide A, for instance, containing 25 per cent. of oxygen, is in contact with the metallic oxide B, containing 10 per cent., they will each remain quiescent in their respective states: but if a solvent C, for which the substance B has no affinity at 10 per cent. of oxygen, but a powerful one at 15 or 20 per cent., comes to be added, then may the oxide A lend a part of its oxygen to B, in order to enable it to combine with the solvent C. Thus when phosphoric acid had dissolved all it could of the pulverized ore, its oxygen in the part undissolved was concentrated, as it were, to the amount of about 20 per cent.; and all that which could not be dissolved, would, through a twofold affinity of copper for oxygen to the amount of 20 per cent., and of phosphoric acid for the oxide of copper of that degree of oxidation, yield up its entire share of oxygen, to favour the combinations which took place in the new order, the only one which could exist among the substances now present.

From the variety of experiments founded upon this reasoning, it has been gathered, that the copper in this ore contains much less oxygen than has ever been suspected in any oxide of copper; and that, from the quantity of the copper which was precipitated in the metallic state by iron, it appears to be combined in the proportion of only $11\frac{1}{2}$ per cent., the rest being pure copper,—a state of metallic concentration of which no instance has as yet been observed in nature.

It is lastly suggested, that, considering not only the great purity of this ore, but also the singular facility with which this useful metal may be extracted from it, it will be found much superior to every copper ore hitherto discovered. It contains no iron and no sulphur; the absence of which latter is a peculiar advantage. It is hence strongly recommended to the proprietors of mines to be particularly attentive to this ore, which is said not to be uncommon in some parts of Cornwall, whereby they are likely not only to further their private advantage, but may also materially contribute to promote the public utility.

A Historical and Anatomical Description of a doubtful amphibious Animal of Germany, called, by Laurenti, Proteus Anguinus. By Charles Schreibers, M.D. of Vienna. Communicated by the Right Hon. Sir Joseph Banks, Bart. K.B. P.R.S. Read March 26, 1801. [Phil. Trans. 1801, p. 241.]

This singular production has hitherto been found only in a small lake in Carniola, called Sitticher See, and has never yet been met